

CLAIMS:

1. A method comprising:
 - monitoring a plurality of physiological parameters of a patient via a medical device, wherein the plurality of physiological parameters includes at least one parameter indicative of patient physical activity;
 - determining when the patient is attempting to sleep;
 - determining values of at least one metric that is indicative of sleep quality based on at least one of the physiological parameters and a determination that the patient is attempting to sleep; and
 - periodically determining an activity level of the patient based on at least one of the physiological parameters and a determination that the patient is not attempting to sleep.
2. The method of claim 1, wherein determining when the patient is attempting to sleep comprises receiving an indication from the patient that the patient is attempting to sleep.
3. The method of claim 1, wherein monitoring a plurality of physiological parameters comprising monitoring at least one signal that indicates posture of the patient, and determining when the patient is attempting to sleep comprises determining when the patient is recumbent.
4. The method of claim 3, wherein monitoring at least one signal comprises monitoring a signal from each of a plurality of orthogonally aligned accelerometers, and determining when the patient is recumbent comprises determining when the patient is recumbent based on a DC component of each of the signals.
5. The method of claim 1, wherein determining when the patient is attempting to sleep comprises determining when the patient is attempting to sleep based on a physical activity level of the patient.

6. The method of claim 5, wherein determining when the patient is attempting to sleep based on activity level comprises:

comparing the activity level to an activity level threshold; and

comparing an amount of time that the activity level remains substantially below the activity level threshold to a time threshold.

7. The method of claim 1, wherein monitoring a plurality of physiological parameters comprising monitoring a level of melatonin within a bodily fluid, and determining when the patient is attempting to sleep comprises determining when the patient is attempting to sleep based on the melatonin level.

8. The method of claim 1, wherein monitoring a plurality of physiological parameters comprises monitoring at least one of posture, heart rate, respiration rate, respiratory volume, and core temperature.

9. The method of claim 1, wherein monitoring a plurality of physiological parameters comprises monitoring at least one of blood pressure, blood oxygen saturation, partial pressure of oxygen within blood, partial pressure of oxygen within cerebrospinal fluid, muscular activity, arterial blood flow, and galvanic skin response.

10. The method of claim 1, wherein the sleep quality metric comprises sleep efficiency, and determining values of the sleep quality metric comprises:

determining when the patient is asleep based on at least one of the physiological parameters; and

determining a percentage of time that the patient is asleep while the patient is attempting to sleep.

11. The method of claim 1, wherein the sleep quality metric comprises sleep latency, and determining values of the sleep quality metric comprises:

identifying a first time when the patient is attempting to fall asleep;

identifying a second time when the patient falls asleep based on at least one of the physiological parameters; and

determining an amount of time between the first and second times.

12. The method of claim 1, wherein determining values of the sleep quality metric comprises:

identifying when the patient is asleep based on at least one of the physiological parameters; and

determining an amount of time that the patient is asleep during a period.

13. The method of claim 1, wherein determining values of the sleep quality metric comprises:

identifying when the patient is asleep based on at least one of the physiological parameters; and

identifying at least one of a number of arousal events and a number of apnea events during a period of sleep.

14. The method of claim 1, wherein determining values of the sleep quality metric comprises:

identifying when the patient is within a sleep state based on at least one of the physiological parameters; and

determining an amount of time that the patient was within the sleep state.

15. The method of claim 14, wherein the sleep state comprises at least one of an S3 sleep state and an S4 sleep state.

16. The method of claim 1, further comprising determining a value of at least one activity metric based on the determined activity levels.

17. The method of claim 15, wherein determining a value of an activity metric comprises determining at least one of a mean and a median of determined activity levels.

18. The method of claim 17, wherein determining a value of an activity metric comprises:
comparing the at least one of the mean and the median activity level to at least one threshold; and
selecting the activity metric value from a plurality of predetermined possible activity metric values based on the comparison.
19. The method of claim 15, wherein determining a value of an activity metric comprises:
comparing each of the activity levels to a threshold value; and
determining at least one of a percentage of time above the threshold and a percentage of time below the threshold.
20. The method of claim 15, wherein determining a value of an activity metric comprises:
comparing each of the activity levels to a threshold value; and
determining an average length of time that consecutively determined activity levels were above the threshold.
21. The method of claim 1, wherein periodically determining an activity level comprises periodically determining a number of activity counts.
22. The method of claim 1, wherein the medical device delivers a therapy to the patient according to a plurality of therapy parameter sets, the method further comprising:
associating each of the determined sleep quality metric values and each of the determined activity levels with a current therapy parameter set;
for each of the plurality of therapy parameter sets, determining a representative value of each of the at least one sleep quality metric based on the sleep quality metric values associated with the therapy parameter set; and
for each of the plurality of therapy parameter sets, determining at least one activity metric value based on the activity levels associated with the therapy parameter set.

23. The method of claim 22, further comprising presenting a list of the therapy parameter sets, associated representative sleep quality metric values, and associated activity metric values.
24. The method of claim 23, further comprising ordering the list of therapy parameter sets according to values of a user selected one of the sleep quality metrics and activity metrics.
25. The method of claim 1, wherein the medical device comprises an implantable medical device.
26. The method of claim 22, wherein the implantable medical device comprises at least one of an implantable neurostimulator and an implantable drug pump.
27. The method of claim 1, wherein the medical device comprises at least one of a trial neurostimulator and a trial pump.
28. A medical system comprising:
a medical device that monitors a plurality of physiological parameters of a patient, wherein the plurality of physiological parameters includes at least one physiological parameter indicative of patient physical activity; and
a processor that determines when the patient is attempting to sleep, determines values of at least one metric that is indicative of sleep quality based on at least one of the physiological parameters and a determination that the patient is attempting to sleep, and periodically determines an activity level of the patient based on at least one of the physiological parameters and a determination that the patient is not attempting to sleep.
29. The medical system of claim 28, wherein the processor receives an indication from the patient that the patient is attempting to sleep.

30. The medical system of claim 28, wherein the medical device monitors at least one signal that indicates posture of the patient, and the processor determines when the patient is attempting to sleep by determining when the patient is recumbent.
31. The medical system of claim 30,
further comprising a plurality of orthogonally aligned accelerometers,
wherein the medical device monitors a signal from each of a plurality of orthogonally aligned accelerometers, and the processor determines when the patient is recumbent based on a DC component of each of the signals.
32. The medical system of claim 28, wherein the processor determines when the patient is attempting to sleep based on a physical activity level of the patient.
33. The medical system of claim 32, wherein the processor compares the activity level to an activity level threshold, and compares an amount of time that the activity level remains substantially below the activity level threshold to a time threshold to determine when the patient is attempting to sleep.
34. The medical system of claim 28, wherein the medical device monitors at least one signal that indicates a level of melatonin within a bodily fluid of the patient, and the processor determines when the patient is attempting to sleep based on the melatonin level.
35. The medical system of claim 28, wherein the medical device monitors at least one of posture, heart rate, respiration rate, respiratory volume, and core temperature.
36. The medical system of claim 28, wherein the medical device monitors at least one of blood pressure, blood oxygen saturation, partial pressure of oxygen within blood, partial pressure of oxygen within cerebrospinal fluid, muscular activity, arterial blood flow, and galvanic skin response.

37. The medical system of claim 28, wherein the sleep quality metric comprises sleep efficiency, and the processor determines when the patient is asleep based on at least one of the physiological parameters, and determines a percentage of time that the patient is asleep while the patient is attempting to sleep as a value of the sleep quality metric.
38. The medical system of claim 28, wherein the sleep quality metric comprises sleep latency, and the processor identifies a first time when the patient is attempting to fall asleep, identifies a second time when the patient falls asleep based on at least one of the physiological parameters, and determines an amount of time between the first and second times as a value of the sleep quality metric.
39. The medical system of claim 28, wherein the processor identifies when the patient is asleep based on at least one of the physiological parameters, and determines an amount of time that the patient is asleep during a period as a value of the sleep quality metric.
40. The medical system of claim 28, wherein the processor identifies when the patient is asleep based on at least one of the physiological parameters, and identifies at least one of a number of arousal events and a number of apnea events during a period of sleep as a value of the sleep quality metric.
41. The medical system of claim 28, wherein the processor identifies when the patient is within a sleep state based on at least one of the physiological parameters, and determines an amount of time that the patient was within the sleep state as a value of the sleep quality metric.
42. The medical device of claim 41, wherein the sleep state comprises at least one of an S3 sleep state and an S4 sleep state.
43. The medical system of claim 28, wherein the processor determines a value of at least one activity metric based on the determined activity levels.

44. The medical system of claim 43, wherein the processor determines an activity metric value as at least one of a mean and a median of determined activity levels.

45. The medical system of claim 43, wherein the processor compares the at least one of a mean and a median activity level to at least one threshold, and selects the activity metric value from a plurality of predetermined possible activity metric values based on the comparison.

46. The medical system of claim 43, wherein the processor compares each of the activity levels to a threshold value, and determines at least one of a percentage of time above the threshold and a percentage of time below the threshold as an activity metric value.

47. The medical system of claim 43, wherein the processor compares each of the activity levels to a threshold value, and determines an average length of time that consecutively determined activity levels were above the threshold as an activity metric value.

48. The medical system of claim 28, wherein the processor periodically determines an activity level by periodically determining a number of activity counts.

49. The medical system of claim 28,
wherein the medical device delivers a therapy to the patient according to a plurality of therapy parameter sets,

wherein the processor associates each of the determined sleep quality metric value and each of the determined activity levels with a current therapy parameter set,

wherein, for each of the plurality of therapy parameter sets, the processor determines a representative value of each of the at least one sleep quality metric based on the sleep quality metric values associated with the therapy parameter set, and

wherein, for each of the plurality of therapy parameter sets, the processor determines at least one activity metric value based on the activity levels associated with the therapy parameter set.

50. The medical system of claim 49, further comprising a programming device including a display that presents a list of the therapy parameter sets, associated representative sleep quality metric values, and associated activity metric values.
51. The medical system of claim 50, wherein the programming device receives user selection of one of the sleep quality metrics and activity metric, and orders the list of therapy parameter sets according to values of the user selected one of the sleep quality metrics and activity metrics.
52. The medical system of claim 28, wherein the processor comprises a processor of the medical device.
53. The medical system of claim 28, further comprising a programming device, wherein the processor comprises a processor of the programming device.
54. The medical system of claim 28, wherein the medical device comprises an implantable medical device.
55. The medical system of claim 54, wherein the implantable medical device comprises at least one of an implantable neurostimulator and an implantable drug pump.
56. The medical system of claim 28, wherein the medical device comprises at least one of a trial neurostimulator and a trial pump.
57. A medical system comprising:
 means for monitoring a plurality of physiological parameters of a patient via a medical device, wherein the plurality of physiological parameters includes at least one parameter indicative of patient physical activity;
 means for determining when the patient is attempting to sleep;

means for determining values of at least one metric that is indicative of sleep quality based on at least one of the physiological parameters and a determination that the patient is attempting to sleep; and

means for periodically determining an activity level of the patient based on at least one of the physiological parameters and a determination that the patient is not attempting to sleep.

58. The medical system of claim 57, wherein means for determining when the patient is attempting to sleep comprises means for receiving an indication from the patient that the patient is attempting to sleep.

59. The medical system of claim 57,
wherein means for monitoring a plurality of physiological parameters comprises means monitoring at least one signal that indicates posture of the patient, and
wherein means for determining when the patient is attempting to sleep comprises means for determining when the patient is recumbent.

60. The medical system of claim 57, wherein means for determining when the patient is attempting to sleep comprises means for determining when the patient is attempting to sleep based on a physical activity level of the patient.

61. The medical system of claim 57, further comprising:
means for delivering a therapy to the patient according to a plurality of therapy parameter sets;
means for associating each of the determined sleep quality metric values and each of the determined activity levels with a current therapy parameter set;
means for determining a representative value of each of the at least one sleep quality metric for each of the plurality of therapy parameter sets based on the sleep quality metric values associated with the therapy parameter sets;

means for determining at least one activity metric value for each of the plurality of therapy parameter sets based on the activity levels associated with the therapy parameter sets; and

means for presenting a list of the therapy parameter sets, associated representative sleep quality metric values, and associated activity metric values.

62. A medical system comprising:

an implantable medical device that delivers a therapy to a patient based on a plurality of therapy parameter sets, monitors a plurality of physiological parameters of the patient including at least one parameter indicative of patient physical activity, determines when the patient is attempting to sleep, determines values of at least one metric that is indicative of sleep quality based on at least one of the physiological parameters and a determination that the patient is attempting to sleep, periodically determines an activity level of the patient based on at least one of the physiological parameters and a determination that the patient is not attempting to sleep, associates each determined sleep quality metric value and each determined activity level with a current therapy parameter set, determines a representative value of each of the at least one sleep quality metrics for each of the plurality of therapy parameter sets based on the sleep quality metric values associated with the therapy parameter set, and determines at least one activity metric value for each of the plurality of therapy parameter sets based on the activity levels associated with the therapy parameter set; and

an external programming device including a display that receives information identifying the plurality of therapy parameter sets and the sleep quality metric values and activity metric values associated with the therapy parameter sets from the implantable medical device, and presents a list of the therapy parameter sets and the associated sleep quality metric values and activity metric values to a user.

63. The medical system of claim 62, wherein the programming device includes a user interface, receives a selection of one of the sleep quality metrics and activity metrics from a user via the user interface, and orders the list of therapy parameter sets according to the associated sleep quality metric values.

64. The medical system of claim 62, wherein the implantable medical device comprises at least one of an implantable neurostimulator and an implantable drug pump.

65. A computer-readable medium comprising instructions that cause a programmable processor to:

monitor a plurality of physiological parameters of a patient, wherein the plurality of physiological parameters includes at least one parameter indicative of patient physical activity;

determine when the patient is attempting to sleep;

determine values of at least one metric that is indicative of sleep quality based on at least one of the physiological parameters and a determination that the patient is attempting to sleep; and

periodically determine an activity level of the patient based on at least one of the physiological parameters and a determination that the patient is not attempting to sleep.

66. The medium of claim 65, wherein the instructions that cause the processor to determine when the patient is attempting to sleep comprise instructions that cause the processor to receive an indication from the patient that the patient is attempting to sleep.

67. The medium of claim 65, wherein the instructions that cause the processor to monitor a plurality of physiological parameters comprise instructions that cause the processor to monitor at least one signal that indicates posture of the patient, and the instructions that cause the processor to determine when the patient is attempting to sleep comprise instructions that cause the processor to determine when the patient is recumbent.

68. The medium of claim 65, wherein the instructions that cause the processor to determine when the patient is attempting to sleep comprise instructions that cause the processor to determine when the patient is attempting to sleep based on a physical activity level of the patient.